J. Parasitol., 88(2), 2002, pp. 419–420

Prevalence of *Toxoplasma gondii* Antibodies in Sera of Domestic Cats From Guarulhos and São Paulo, Brazil

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ABSTRACT: Antibodies to *Toxoplasma gondii* were determined in serum samples of 502 domestic cats from Brazil by the modified agglutination test (MAT), using formalin-fixed whole tachyzoites and mercaptoethanol. Antibodies (MAT ≥ 1:20) were found in 132 (26.3%) of 502 cats. With respect to origin, antibodies were found in 26.7% of 430 stray cats from São Paulo, 10% of 40 stray cats from Guarulhos, and 40.6% of 32 cats from a cat breeder in São Paulo. Antibody titers were: 1:20 in 10 cats, 1:25 in 40 cats, 1:50 in 73 cats, and ≥1:500 in 9 cats. Exposure rates of *T. gondii* in cats from São Paulo, Brazil are similar to that in domestic cats in North America.

Infections by *Toxoplasma gondii* have been reported in numerous species of warm-blooded animals worldwide (Dubey and Beattie, 1988). Cats are pivotal in the transmission of *T. gondii* to humans and other animals because they are the only hosts that can excrete the environmentally resistant oocysts in feces (Dubey and Beattie, 1988). Because oocysts are rarely found in feces of cats, serologic prevalence data in cats are important for the determination of epidemiologic significance of *T. gondii* infection (Dubey, Weigel et al., 1995).

Antibodies to *T. gondii* have been reported in domestic cats from Brazil, in São Paulo city, São Paulo (Sogorb et al., 1972; Santos et al., 1983; Lucas et al., 1999), Botucatu, São Paulo (Salata et al., 1985), Jaguapitã, Paraná (Garcia et al., 1999), and Manaus, Amazonas (Ferraroni et al., 1980). The number of cats examined ranged from 9 to 248 and the prevalence of antibodies to *T. gondii* ranged from 0% to 81.0%. Most of these surveys were done approximately 20 yr ago. The objective of the present paper is to document the prevalence of *T. gondii* antibodies in cats from São Paulo and Guarulhos, São Paulo State, Brazil.

Sera were collected during 1993 to 2000 from a total of 502 domestic cats (*Felis catus*) from São Paulo and Guarulhos cities, São Paulo State in Brazil. A total of 470 stray cats was captured by Center for Zoonosis Control of São Paulo and Guarulhos. Thirty-two cats were from a breeder in São Paulo; 26 of these 32 cats were born in house, and 6 were feral.

Cats were physically or chemically restrained using ketamine and xylazine. Blood samples were collected from each animal, and sera were stored at −20 C until serologic analysis.

Sera were analyzed for antibodies to *T. gondii* at the Parasite Biology, Epidemiology, and Systematics Laboratory of the U.S. Department of Agriculture, Beltsville, Maryland by the modified agglutination test (MAT) using formalin-fixed whole tachyzoites and 2-mercapthoethanol as previously described (Dubey and Desmonts, 1987). Sera were thawed and frozen several times for testing. Sera were initially screened in 1:25, 1:50, and 1:500 dilutions. Sera with doubtful result at 1:25 dilution were reexamined in 1:10, 1:20, and 1:40 dilutions. A titer of ≥1:20 was considered indicative of past *T. gondii* infection (Dubey and Thulliez, 1989; Dubey, Lappin, and Thulliez, 1995a, 1995b). Controls were included in each test.

Antibodies (MAT ≥ 1:20) to *T. gondii* were found in 132 (26.3%) of 502 cats. With respect to origin, antibodies were found in 26.7% of 430 stray cats from São Paulo, 10% of 40 stay cats from Guarulhos, and 40.6% of 32 cats from a breeder in São Paulo. Antibody titers were: 1:20 in 10 cats, 1:25 in 40 cats, 1:50 in 73 cats, and ≥1:500 in 9 cats (Table I). Seven of 58 (12.1%) kittens (<12 wk), 10 of 71 (14.1%) young cats (<6 mo), and 14 of 61 (22.9%) adult cats were seropositive; age was not recorded for 313 cats. Antibodies in 7 kittens were low (3, 1:20; 4, 1:25) and might have been acquired colostrally. Colostrally acquired *T. gondii* antibodies disappear in kittens by 16 wk of age (Dubey, 1973; Dubey, Lappin, and Thulliez, 1995b).

The seroprevalence of *T. gondii* antibodies found in the present study was different from those reported previously from Brazil (Table II). It is not possible to compare results of the present study with other surveys in cats from Brazil, because of the sample size, period of survey, and the type of serologic test used. The present study used MAT, which is considered the most specific and sensitive for determining *T. gondii* antibodies in cats (Dubey and Thulliez, 1989; Dubey, Lappin, and Thulliez, 1995a, 1995b).

The seroprevalence of *T. gondii* in humans varies depending on the region, age of the people, and the economic status of the population. For example, in a recent study, Bahia-Oliveira et al. (2001) found that *T. gondii* prevalence in 6- to 10-yr-old children in Campos dos Goytacazes, Rio de Janeiro varied from 70% to 0%, and it was correlated with hygienic and social conditions. The group with the highest prevalence was very poor economically and could not afford to eat meat. The ingestion of food and water contaminated directly with oocysts was considered to be the main source of infection. Souza et al. (1987) also reported that 68.4% of 6- to 8-yr-old children in Rio de Janeiro, Brazil had antibodies to *T. gondii*. Thus, in certain areas of Brazil there is a wide contamination of environment with *T. gondii* oocysts.

Results of this present study indicate that 26.3% of cats from São Paulo and Guarulhos, Brazil were exposed to infection to *T. gondii*. Cats generally become infected with *T. gondii* by ingestion of tissue cysts from uncooked or undercooked infected meat (Dubey and Beattie, 1988). Freezing of meat kills tissue cysts of *T. gondii* (Kotula et al., 1991). Therefore, all meat should be frozen before feeding to cats. The higher seroprevalence of *T. gondii* in cats in the breeder facility than in other cats may be because the owner probably fed uncooked meat to the cats.

We are grateful to Danilli Del Guercio (breeder), Renato Caravieri,

TABLE I. Antibodies to *Toxoplasma gondii* by the modified agglutination test (MAT) in cats from areas or type in São Paulo, Brazil.

Area or type	No. of cats examined	No. positives with MAT antibodies (≥1:20)	Percent positive (%)	No. of cats with MAT titers of:		
				1:20 or 1:25	1:50	≥1:500
São Paulo	430	115	26.7	38 (6* + 32†)	68	9
Guarulhos	40	4	10.0	2 (1* + 1†)	2	0
Breeder	32	13	40.6	10 (3* + 7†)	3	0
Total	502	132	26.3	50 (10* + 40†)	73	9

* = Titer of 1:20.
† = Titer of 1:25.

TABLE II. Prevalence of antibodies of *Toxoplasma gondii* in sera of domestic cats from Brazil.

Locality*	Reference	Test†	No. of cats	% +.‡	% positive of cats with titers of: 16	20	25	50	64	128	256	≥500	1024	>1024
São Paulo—SP	Sogorb et al. (1972)	DT	130	50.8									5	5.4
Manaus—AM	Ferraroni et al. (1980)	IHA	32	81.0						81				
São Paulo—SP	Santos et al. (1983)	IHA	100	59.0					1		3		19	36
Botucatu—SP	Salata et al. (1985)	IFA	9	0	4.8									
São Paulo—SP	Lucas et al. (1999)	IFA	248	17.7	7.4				5.7		4.8		1.2	1.2
Jaguapitã—PR	Garcia et al. (1999)	IFA	163	73.0					10.4		16		12.3	27
São Paulo, and Guarulhos—SP	Present study	MAT	502	26.3		2	8	14.5				1.8		

* SP = São Paulo, AM = Amazonas, PR = Paraná.
† DT = dye test, IHA = indirect hemagglutination, IFA = indirect fluorescent antibody, MAT = modified agglutination test.
‡ = Percentage of seropositive cats.

Vanessa Muradian, Maria Fernanda V. Marvulo, and Sandra Nishi for their assistance and support in collection of the samples.

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